



COMMISSION INTERNATIONALE DE L'ÉCLAIRAGE  
INTERNATIONAL COMMISSION ON ILLUMINATION  
INTERNATIONALE BELEUCHTUNGSKOMMISSION

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## DIVISION 2 : PHYSICAL MEASUREMENT OF LIGHT AND RADIATION

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Home Page: <http://cie2.nist.gov>

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May 29, 2007

### Minutes of 2006 CIE Division 2 Meeting

9:00 – 17:00, 16 June 2006

Braunschweig, Germany

#### Abbreviations:

AD: Associate Director  
CIE CB: CIE Central Bureau  
CIE BA: CIE Board of Administration  
CM: Country Member  
DD: Division Director  
ILV: International Lighting Vocabulary  
ML: Member List  
NC: National Committee  
TC: Technical Committee  
TCC: Technical Committee Chair  
TR: Terms of Reference  
D2: Division 2 (D1, D4, D8, likewise)  
ST: Status  
VP: Vice President  
WG: Working Group

#### Attendees:

<u>Jean Bastie</u>	INM-CNAM, <u>France</u> (CIE VP)
<u>Peter Blattner</u>	METAS, <u>Switzerland</u> (TC2-59 chair)
Ulrich Binder	OSRAM, Germany
Wout van Bommel	Philips, Netherlands (CIE President)
Ellen Carter	Konica-Minolta, USA (D1 Editor)
<u>Antonio Corrons</u>	IFA-CSIC, <u>Spain</u>

Jeanne-Marie Coutin	INM-CNAM, France
Richard Distl	Instrument Systems, Germany
George Eppeldauer	NIST, USA (TC2-48 chair)
László Fülep	GE Hungary, Hungary
<u>Jim Gardner</u>	NMIA, <u>Australia</u> (D2 Editor, TC2-44 chair)
<u>Teresa Goodman</u>	NPL, <u>UK</u> (D2 DD)
Teng-Hai Lau	Philips Lumileds, Malaysia
Werner Halbritter	OSRAM, Germany
<u>Franz Hengstberger</u>	CSIR-NML, <u>South Africa</u> (CIE VP, President Elect)
Günther Heidel	OSRAM OptoSemiconductors, Germany (R2-36)
Steve Jenkins	Steve Jenkins and Assoc., Australia
Werner Jordan	OSRAM, Germany
Hyun-Ho Kim	Samsung, Korea
Kohtaro Kohmoto	Teknologue, Japan (D6 AD, TC2-58 chair)
Thomas Larason	NIST, USA (TC2-29 chair)
Dong-Hoon Lee	KRISS, Korea
Cameron Miller	NIST, USA (TC2-56 chair)
<u>Kathleen Muray*</u>	INPHORA, <u>USA</u> (TC2-45 chair)
Gael Obein	INM-CNAM, France
Yoshi Ohno	NIST, USA (D2 Secretary, TC2-37 & TC2-49 chair)
Kosei Oshima	Otsuka Electronics, Japan
Makoto Okawauchi	Otsuka Electronics, Japan
Dae-Hee Park	Wonkwang Univ., Korea
Seongchong Park	KRISS, Korea
<u>Seung-Nam Park</u>	KRISS, <u>Korea</u>
Sunglim Park	Optel Precision, Korea
<u>Jianguan Pan</u>	Everfine, <u>China</u>
<u>Etienne Pierson</u>	Laborelec, <u>Belgium</u> (R2-37)
Reiner Rattunde	LMT, Germany (TC2-40 chair)
Gerhard Rösler	GretagMacbeth, Germany (TC2-53 chair)
<u>Ichiro Saito</u>	NMIJ-AIST, <u>Japan</u>
<u>Georg Sauter</u>	PTB, <u>Germany</u> (D2 AD, TC2-43 chair)
John Scarangelo	Philips Lumileds, USA (TC2-46 chair)
Jens Schuette	EBT Optronik Systems, Germany (TC2-50 chair)
<u>Mihai Simonescu</u>	NiM-Romania, <u>Romania</u>
<u>Marek Smid</u>	CMI, <u>Czech Republic</u>
Peter Sperfeld	PTB, Germany
Armin Sperling	PTB, Germany
Walter Steudtner	OSRAM, Germany
<u>Raisa Stolyarevskaya</u>	ACOL Technologia, <u>Russia</u>
Shu Takeshita	Tokai University, Japan
<u>Kamuran Turkoglu</u>	UME, <u>Turkey</u>
Guy Vandermeersch	IBE-BIV, Belgium (D2 AD, TC2-23 & TC2-53 chair)
<u>Predrag Vukadin</u>	FBMPM, <u>Yugoslavia</u>
Nobert Wagner	OSRAM, Germany
Pierce Webb	USA

Emma Woolliams	NPL, UK (TC2-60 chair)
<u>Joanne Zwinkels</u>	NRC, <u>Canada</u> (TC2-25 chair)

Total **54** persons from **21** countries, including **15** country members. Underlines indicate country members. \* proxy for country member.

## **Handouts**

Agenda of 2006 Division 2 meeting (**Attachment 1**)

List of the country members, TCs, Reporterships, and Liaisons.

## **Opening**

Division Director, Teresa Goodman, opened the meeting at 9:00 a.m. and welcomed everyone present.

### **1. Attendance List, Apologies**

Secretary received regrets from the following persons:

- Carl Andersen (Vice President of CIE-USA)
- John Clare (New Zealand)
- Iakyra Couceiro (Brazil)
- Toni Gugg-Helminger (Germany)
- Neil Hodson (USA, TC2-32 chair)
- Werner Horak (Germany)
- Erkki Ikonen (Finland country member)
- Norb Johnson (D2 AD, USA country member)
- Jerzy Pietrzykowski (Poland country member)
- Mike Pointer (UK, TC2-28, TC2-61 chair)
- Alan Robertson (Canada, TC2-57 chair)
- Danny Rich (USA, TC2-39 chair)
- Janos Schanda (Hungary)
- Ian Tutt (UK)
- Richard Young (USA)

### **2. Introductions**

All participants introduced themselves.

### **3. Approval of Agenda**

The agenda for this meeting was previously distributed via the website (**Attachment 1**). The agenda was approved with no changes, except the orders of AD reports would change.

### **4. Approval of the 2005 D2 meeting minutes**

The minutes of the 2005 D2 meeting in Leon, Spain, which were distributed via e-mail circular and on the website, were approved with one change. In the report of TC2-23, the last

sentence, stating that the issues on measurements of TL5 lamps would be handled in a new Technical committee, should be deleted.

DD Goodman thanked Secretary for his hard work producing these excellent minutes. She also requested all the TC chairs present at the meeting to send written reports to Secretary afterwards to help produce accurate minutes more easily, and also those TC chairs not present to send short status reports so that next Activity Report will be completely up to date.

## **5. Director's Report (T. Goodman)**

### ***Reports on general CIE activities***

1) Next Board meeting will be in October this year, and the focus of the meeting will be to finalize the technical program for Beijing. DD reminded everyone that the deadline for submitting abstracts is September. In October, Board will review all abstracts, select papers, etc., and arrange meeting schedules. There will be some unavoidable overlaps of meetings between Divisions as usual, but the Board will do their best to minimize conflicts. DD asked those who submit abstracts to send her a copy also, so that she can prepare early.

2) It was reported last year that the Board planned to have an extra day at the next Board meeting to discuss future direction of the CIE, e.g., Division structure. The Board asked for inputs from people in advance of this discussion, but responses were very low, which indicated that the current arrangements are generally satisfactory; thus the extra day was cancelled. But, DD emphasized that we want to make best use of everyone's time, and she welcomes any suggestions on how the CIE work can be made more efficient and productive, and best way to coordinate our work.

3) The CIE webshop for publication has been running already for some time, and DD asked for any comments from those who have used it. There were positive responses from the several of the participants and no issues were raised. DD mentioned that standards and publications of other bodies such as ISO, DIN, ASTM and IESNA are also available on the webshop (these can be found by searching on the relevant standard number or title). CIE receives a small margin from sales of all publications ordered through the CIE webshop, regardless of whether or not they are produced by the CIE, and DD therefore recommends using CIE webshop for all such documents.

4) Also reported last year was the list of CIE 'recommended journals'. Most of the journals that are directly relevant to light and lighting are not listed on the Scientific Citation Index, which often discourages researchers at universities in particular from submitting their papers to these journals; many papers therefore appear in less-relevant publications. The purpose of the CIE List is to publicly-recognize those journals in light and lighting that can be considered as being of the same quality as those on the Citation Index. Criteria have been agreed for acceptance of journals on the CIE List, and the first three journals have been accepted. This initial list will be published very shortly in CIE News. The procedure for a journal to be listed is that the journal editor should approach CIE to ask for acceptance and provide evidence to demonstrate that they meet the published criteria. Applications are then reviewed and, if they meet the criteria, approved by the Publication board and the CIE Board. If D2 members know

of any journals should be listed, they should suggest that the editor to approach CIE. Hengstberger added that Divisions could also propose journals to be listed (but they must still meet the same procedures for acceptance).

5) Related to Board's work on ILV, DD asked Jean Bastie to give a brief report. The new ILV is being prepared in two separate chapters, one for basic terms, another for applied terms. All the terms are listed in alphabetical order. There have been a lot of discussions on harmonization of these terms, as the work was done separately in each Division and there were some conflicting definitions. These have been resolved, and the new ILV is near completion, though the timetable is not yet clear. Kohmoto asked about IEC/CIE joint publication. First ILV will be published as CIE work, then CIE will offer IEC to adopt as joint publication.

### ***General issues relating to Division 2 activities***

1) Uncertainty evaluation is currently a very active topic, as apparent from the highly successful symposium just held. Many of our TCs are therefore beginning to prepare sections on uncertainty evaluation in their draft reports, which might duplicate the contents of the TC2-43 report or, more seriously, conflict with it. It is important that messages that come out from the CIE are consistent and that people have a central reference rather than looking for information in different reports. Thus, DD has decided to set up a small working group within the D2 management team to prepare guidelines for TCs, setting out what level of detail they should include in their reports, what aspects should be covered, where reference should be made to the TC2-43 report, etc., in order to have consistency in the way we treat uncertainties in all D2 work. DD asked all the TC chairs to hold any work on the uncertainty sections of their reports until the guidelines are produced. It should be ready in two months or so and will be notified to everyone by an email circular and website.

Answering questions, DD added that all TC chairs should have a copy of the TC2-43 draft document, and noted that there will certainly be differences between technical reports and standards in terms of the way in which information relating to uncertainties should be presented. A template for the uncertainty sections of reports might also be considered.

2) The TC meetings this time were attended by a large number of people, with more than 80 present at one of the meetings. Running a TC meeting in such cases is difficult. DD heard that many participants were disappointed that they did not understand what was being discussed, and felt that not enough background information was given. DD apologized for that situation, but she emphasized that the purpose of TC meetings is to move the TC work forward. While a short introduction of the objectives of the TC can be helpful for members as well as observers, and should be encouraged, it is not the purpose of the TC meetings to spend time explaining the background to the work or reconsidering issues that have already been debated by the TC members. DD also heard that, after the TC meetings, many people asked to become members. DD has a concern that some TCs already have more than 30 members, and that too large a membership will make it difficult for TCs to work effectively.

Considering the best way to manage this, DD suggested that stricter guidelines should be set up for acceptance of new members by the TCC. Those who wish to be a member of a TC

should contact the TC chair in writing, including information on what expertise they have to offer that is relevant to the work of the particular TC and making a firm commitment to contribute. The TCC should consider their requests based on this information. The same should be done in the case of inactive existing members, to reconfirm their interest. DD emphasized that acceptance of members is the discretion of TCCs and they should manage the membership list for efficient TC work.

Lengthy discussions followed, and the following points were discussed (these are not necessarily consensus):

- It would not be realistic to set a limit to the number of members.
- In the course of TC work, if any member is not active at all, such members should be deleted. Such members, however, should be contacted first before being deleted so that they have a chance to object.
- If anyone contributed at early stage and became inactive later, the person should still be kept as a member, and such information should be handed over if the TC chair changes.
- Each country has a right for one member for each TC, and such a request would be accepted, but if the person is not active, the same rule should apply.
- There could be an option to keep some people as observers, but we should be careful that those who only want to collect information from the TC should not be members.
- Attendance lists for TC meetings should not include a column *member/guest*.
- The members are listed in the final publication is not consistent. Some reports show lists of *members* and *advisors* but others show only members. Some TCs list all those who voted as members. Some guidelines are needed for finalizing member list for publication as well as managing membership during the course of TC work.

It was agreed that DD would draw up some guidelines for TC membership and bring the issue to the attention of all on the D2 mailing list.

Murray made a suggestion related to all TC work. In her experience, the scope (TR) of the TCs tends to be too general, and the TC work takes a long time. Industry generally needs standards more quickly, e.g., standards on LED measurements. She suggested that it would be better to have more TCs with fewer set goals and to try to finish the work done more quickly. DD agreed in general that TC work should be done more quickly, but she also expressed concern about having too many TCs for small questions. DD emphasized that, although TR are defined when the TC is established, it is possible to change these later (with the agreement of the Board) to adapt to changes of situation or industry requirements. Heidel added that, in the case of LEDs, changes are so fast and new devices keep coming out and new questions keep rising, which delays the TC work. DD reiterated her point that the TR can be changed in such cases, e.g., to exclude these new devices in the scope so that the document can be finished without dealing with new questions.

## **6. Secretary's Report (Y. Ohno)**

**Membership:** D2 now has 36 country members, no change from last year. The country representatives of Brazil, Turkey, and South Africa have changed since the last D2 meeting.

**Reports Issued:** The minutes of the 2005 D2 meeting (Leon, Spain) were produced and distributed via e-mail circular in May 2006. The Activity Report – May 2006 was also produced and distributed at the same time. Secretary apologized for the delay of distributing the minutes this time due to some difficulties in his work schedule for the past year.

**Division 2 Mailing List:** This now has 193 persons (last year 190). The e-mail addresses are protected, and are available as the subscriber list of the D2 email reflector, which is password-protected (user id: cie2, password=vienna). The Secretary tries to keep all the addresses updated as far as possible, but there are always a few addresses that do not work. The Secretary therefore requests everyone to inform him of any changes of e-mail address, to ensure that D2 information can be distributed to everybody. The message archive is also available and accessible with the same password.

**D2 website:** This has been updated as often as necessary. There have been no major changes in structure. The TC status is updated every year on the TC page. We have 11 TC drafts posted with password protection. Secretary requested all the TC chairpersons to send him a copy when they distribute a new TC draft so these can be updated. We have a global password that can access all TC documents and TC passwords that can access each TC documents. The global password is distributed only to CMs, TC chairs and management team. The passwords for each TC can be distributed to all members of each TC.

**E-mail reflectors:** TC2-60 has been added recently and now we have six email reflectors for TCs. These are created on a request basis. TC chairs who wish to create a reflector should contact Secretary. All email reflectors are protected not to distribute messages other than from subscribers. The subscriber lists are available at links at the bottom of D2 home page (protected by the same password). Secretary encourages all TC chairs to use email or email reflectors to make progress in between TC meetings.

**Symposia:** Secretary assisted PTB organizing the Uncertainty Symposium and scheduled the ten TC meetings in one and half day in Braunschweig this time.

DD Goodman asked all the TC chairs to make sure that the latest draft of all the TCs are available to Secretary so that the list on the website is complete. DD also emphasized the usefulness of the email reflectors, e.g., when feedback is needed on some specific questions quickly.

Finally, DD expressed her big thanks to Secretary for his continuing excellent work on website, reports, and organizing meetings. This was enthusiastically endorsed by all those present.

## **7. Editor's Report (J. Gardner)**

Two standards have gone to NC ballot since the last meeting:

CIE DS 014-1.3 "COLORIMETRY - PART 1: CIE STANDARD COLORIMETRIC OBSERVERS  
CIE DS 014-2.3 "COLORIMETRY - PART 2: CIE STANDARD ILLUMINANTS"

In the NC vote, only 10 country members (out of 36) responded to the ballot. One negative vote received from Hungary has been resolved, and both documents will be sent shortly to CB for publication.

The status of ILV was covered in Director's report as reported by Bastie. Many documents refer to the numbering of items in ILV. The numbering will disappear in the new ILV, and items will be listed by name only. D2 terms are all in basics area. Changes in D2 terms are mostly addition of new terms, and changes in old terms are very few (including distribution temperature).

TC2-39 has gone through NC ballot and closed a few weeks ago. TC2-16, 25, 40, 45, 48 are well advanced and put into CIE draft format, and close to going to TC ballots and NC ballots. TC2-45 is already in TC ballot.

The Editor's role is to allow TCs to concentrate on technical matters, without spending time on formatting the details of the document and correcting typographical and grammatical errors. The Editor asks TC chairs to resend the document to him after substantial additions or alterations, and before ballots.

Editor recommends TC chairs to use the TC draft template from the early stages of the document. This is available at: <http://www.cie.co.at/about/procedures.html>. He recommends use of Insert Comments on the draft for queries, and the use of Track Changes so TC members can review any alterations made. Use Equation Editor for equations and complex expressions, and Mathtype (a bug in Word was noted when cutting and pasting objects). He does not recommend the use of Endnote for references unless all authors have access to it. Word has various editing tools such as styles for paragraphs, numbering, table of contents, cross-referencing, bookmarks for field codes, etc. While Editor can insert these in TC draft documents as appropriate during editing, he recommends that TC chairs learn these and use them from the early stages of the document.

Vandermeersch suggested that TC members be informed when document has been sent for Division ballot or NC ballot. Secretary will ensure that voting information will be posted on the website (What's new area) and also to send an email circular.

It was also noted that attachments in email can be stripped off by firewalls. It may be better to send an email with no attachment and the file can be downloaded from the website. Secretary commented that he can post documents on the website (in the TC area) when requested by TC chair, but it can be attached to email as well.

DD Goodman thanked the Editor for his hard work to sort out a number of tricky issues and for always responding very quickly to requests.

## **8. Progress Reports from Technical Committees, Reporters, and Liaison Persons**

### **8.1. Associate Director Vandermeersch and TC chairpersons**

Reports on TCs 2-23, 49, 50, 52, 61 were given.



## **8.2. Associate Director Johnson and TC chairpersons**

Reports on TCs 2- 17, 19, 25, 28, 32, 39, 42, 44, 51, 53, 56, 57 were given.

## **8.3. Associate Director Sauter and TC chairpersons**

Reports on TCs 2-16, 29, 37, 40, 43, 45, 46, 47, 48, 58, 59, 60 were given.

The reports given for 8.1, 8.2 and 8.3 are summarized below in TC numerical order.

### **TC2-16** Characterization of the performance of tristimulus colorimeters

**Chair:** J. Schanda (Hungary)

**AD:** Sauter

**ML:** Bittar (New Zealand), Denner (South Africa), Goodman (UK), Gundlach (Germany), Hengstberger (South Africa), Moore (UK), Muray (USA), Ohno (USA), Oleari (Italy), Pointer (UK), Rastello (Italy), Rattunde (Germany), Sakai (Japan), Sauter (Germany), Sugiyama (Japan), Terstiege (Germany)<sup>†</sup> – revised Nov. 2005.

**TR:** To produce a report recommending methods for assessing the performance of tristimulus colorimeter heads for measuring chromaticity coordinates.

**ST:** Secretary read a written report from Schanda. Draft 13 has been voted in favor by the TC, with one negative vote. Editorial comments were made by the CB and these have been incorporated in the draft. Unfortunately the Editor used an earlier draft for this editing, and using the CIE Template destroyed some earlier editorial corrections. The Editor tried to solve the negative vote mentioned above, but this produced some further questions. The Chair is now in contact with the Editor to sort out the still open question; it is anticipated that a further vote by the TC will be necessary before it can be circulated in D2 and BA. This document is very close to publication. It was also mentioned that CIE Colorimetry book will shortly be published from Wiley, and there is a chapter on tristimulus colorimeters, which may be useful.

[Update] TC2-16 report has been published as [CIE 179:2007 Methods for Characterising Tristimulus Colorimeters for Measuring the Color of Light](#). (2007-5-18)

### **TC2-17** Recommendation for integrated irradiance and spectral distribution of simulated solar radiation

**Chair:** G. Zerlaut (USA)

**AD:** Johnson

**ML:** Chomiczewski (USA), Cordo (USA), DePietro (USA), Ellersick (USA), Christiaens (France), Grossman (USA), Gueymard (USA), Ketola (USA), Martin (USA), Myers (USA), Riedl (Germany), Robbins III (USA), Schoenlein (Germany), Scott (USA), Severon (Germany) – revised March 2006.

**TR:** Revise and update CIE Publication No.20 (1972)

**ST:** No report received from TCC. Secretary mentioned that Zerlaut first planned to hold a TC meeting in Braunschweig, but there would not be enough members, and then planned to have a meeting jointly with ASTM committee week in Toronto.

[Update] Report received from Zerlaut after the meeting (2006-7-6): TC2-17 met on 28 June 2006, in Toronto, Canada. It has been agreed that the TC's work will be based on SMARTS2 version 2.9.5. Two other salient results of the meeting are: [1] Relevant tables of CIE Publication #85 will be re-constituted using SMARTS2 ver2.9.5 and will initially include Tables 2, 4 and Column 2 of Table 8; [2] the Chair will appoint four initial task group leaders whose function will be to provide the TC with atmospheric and geometric input parameters for spectral energy distributions designed for their specific

applications. The re-constituted Publication #85 spectra noted above will be made available before the next meeting, which is planned for the spring of 2007 in Europe. A major agenda item for the next meeting will be to establish criteria for breaking down the detailed spectral energy distributions into wavelength bands that are amenable to simulations - and to being measured.

**TC2-19** Measurement of the Spectral Coefficient of Retroreflection

**Chair:** N. Johnson (USA)

**AD:** Johnson

**ML:** Arens (USA), Brekke (Norway), Fisher (USA), Hsia (USA), Hubert (France), Kurioka (Japan), Price (UK), Rendu (France), Rennilson (USA), Richey (Germany), Schreiber (Germany), Sugiyama (Japan), Terstiege (Germany), Vandermeersch (Belgium)

**TR:** Identify the critical measurement parameters, tolerances, and requirements for, and conduct an international intercomparison of, the spectral coefficient of retroreflection.

**ST:** Goodman read a report from Johnson. The completion of this committee work has taken longer than anticipated, and TCC is still working on the final report. The technical work has been completed and results have been circulated informally to the TC for some time. TCC intends to get the final draft to Editor and complete the TC's work by the end of this quadrennial.

**TC2-23** Photometry of Street-Lighting Luminaires

**Chair:** G. Vandermeersch (Belgium)

**AD:** Vandermeersch

**TR:** Prepare a technical report on the photometry of street lighting luminaires.

**ML:** Ian Lewin (USA), A. Blochouse (Belgium), A. Corrons (Spain), L. Bedocs (UK), A. Por (France), C. Stratford (UK), R. Rattunde (Germany), G. Rossi (Italy), D. Gibbs (UK), A. Ottoson (Sweden) – rev. 2003.

**ST:** Vandermeersch reported. The TC has not met since Leon, but TCC is organizing a meeting in September. The intention of the TC is to prepare a short addendum document to CIE 121, which will be numbered CIE 121-Part 2-2 and will definitively replace the old publication CIE 27. This will cover photometric data to be measured (on the basis of D4 work), photometric methods, uncertainties and tolerances. The following specific items to be dealt with were identified at the San Diego TC meeting: transformation of photometric intensity tables measured according old CIE 30-2; minimum measurement steps to guarantee accuracy in intensity interpolations for lighting calculations; clear conventions to fix the mechanical axes of the luminaire against the coordinate system; solve contradictions between CIE 140 and CIE 121 regarding the first axis of a luminaire; measurement of critical intensities for TI calculations (angles above 70°; measurements of critical intensities and upward flux for glare classification; specific problems linked to the technology of new light source lamps (correct positioning, warm-up time, stabilization, etc). There has been no major progress on these work items since the San Diego meeting, except for the last but important item.

**TC2-25** Calibration Methods and Photoluminescent Standard for Total Radiance Factor Measurement

**Chair:** J. Zwinkels (Canada)

**AD:** Johnson

**ML:** Bristow (Sweden), Erb (Germany), Leland (USA), McCamy (USA), Nayatani (Japan), Puebla (Germany), Racz (Hungary), Simon (USA), Witt (Germany), Clarke (UK) -

revised Aug. 2002

**TR:** Prepare a CIE report on methods for measurement of total radiance factor of photoluminescent materials. Recommendations for realizing and calibrating photoluminescent standards by the one and two-monochromator methods will be included.

**ST:** Zwinkels reported. A final version of the TC Report (Draft 12) was prepared by the TCC that incorporated the input of TC voting and editorial comments by TC members for Draft 11 and a revision of terms in the section on Terminology (Section 1.2) to make them consistent with the new fluorescence terms published in the CIE Standard on the Assessment of the Spectral Quality of Daylight Simulators for Visual Appraisal and Measurement of Colour (CIE S 012/E:2004). TCC has sent this final draft to the D2 Editor and he has completed the editorial review of this document. The revised draft (Draft No. 12.2 dated 2006-06-06) is now ready to be sent for Division ballot.

[Update] CIE CB has received completed draft and is preparing to start Division/BA ballot. (2007-5)

#### **TC2-28** Methods of characterizing spectrophotometers

**Chair:** Mike Pointer (UK)                      **AD:** Johnson

**ML:** Andor (Hungary), Bastie (France), Berns (USA), Distl (Germany), Eckerle (USA), Konstantinova (Bulgaria), McCamy (USA), Robertson (Canada), Sugiyama (Japan), Ulyanov (Russia), Zwinkels (Canada)

**TR:** Write a CIE report on the characterization of spectrophotometers by means of reference materials and other methods, with particular reference to linearity, wavelength error, stray light, and integrating sphere errors.

**ST:** Goodman reported. A written report also was received from TCC Pointer. The latest draft is Draft 6. Since taking over the Chairmanship of this TC from Peter Clarke in 2004, TCC has been working on the draft of the technical report. His understanding was that the report was near to completion and merely needed review and editing before committee ballot. TCC circulated Draft 5 and received a response from only one member out of 9 members. But it is clear from the comments that the report needs further work of a technical nature (mainly uncertainty issues) for which TCC does not have the technical expertise to complete. Since Pointer was retiring and to resign the chairmanship, Goodman proposed that she would take over this TC for a short time to finish this document. The change was approved by D2 unanimously. Carter suggested that TC members should be updated. The latest draft has not been sent to all TC members, nor the Editor, and this should be done.

#### **TC2-29** Measurement of Detector Linearity

**Chair:** T. Larason (USA)                      **AD:** Sauter

**ML:** Bastie (France), Clare (New Zealand), Distl (Germany), Eppeldauer (USA), Goodman (UK), Webb (USA), Palmer (US), Sauter (Germany), Andor (Hungary), Bittar (New Zealand), Budde (Canada), Dezsai (Hungary), Mihailov (Russia), Moestl (Germany) - July 2003.

**TR:** Prepare a CIE guide on methods for the characterization of the linearity of detectors of optical radiation, including different principles by which the linearity of detectors can be determined and causes of non-linear behavior, to aid users of optical radiation detectors

in the selection and use suitable devices for specific applications.

**ST:** Larason reported. TC met on June 15 in Braunschweig, attended by 47 people, including 7 members. Draft 4 (2006-5) was circulated to the committee before the meeting, and was discussed at the meeting. Most of the discussion centered on the TR and definitions. In particular, there was lengthy debate on whether to strictly follow the TR and TC title and limit the document to detectors only (e.g., photodiodes) or to use the term “detector” in a broader sense and include amplifiers and possibly displays. The later, broader use of the word “detector” seems to be in line with the intent of the TR since the document is a report for the general user as a “guide” and “aid”, and not a standard. This led to a discussion of proposed ILV terms for “detector” and “linear detector” and whether these terms should be used in the report or whether new terms should be defined. The meeting agreed TCC should review the proposed ILV terms for “detector” and “linear detector” and suggest to the TC whether these new terms should be used and if the TR should be modified. 8 people requested to join the TC, which will be followed up using the new membership guidelines.

#### **TC2-32** Measuring Retroreflectance of Wet Horizontal Road Markings

**Chair:** N. Hodson (USA)

**AD:** Johnson

**ML:** Austin (USA), Davies (USA), Dibbern (Germany), Hubert (France), Johnson (USA), Lundkvist (Sweden), Meydan (Australia), Meseberg (Germany), Rennilson (USA), Schmidt-Clausen (Germany), Schnell (USA), Schreuder (Netherlands), Soardo (Italy), Sorenson (Denmark) - revised August 1999

**TR:** To prepare a guide for the methods of measuring coefficient of retroreflected luminance (specific luminance) of horizontal road markings under wet weather conditions.

**ST:** Secretary reported. Hodson stated in a recent email that he retired from 3M last fall but would continue chairmanship of this TC to finish the TC work. The document is close to completion and TCC will send it to Editor soon.

#### **TC2-37** Photometry Using Detectors as Transfer Standards

**Chair:** Y. Ohno (USA)

**AD:** Sauter

**ML:** Andor (Hungary), Austin (USA), Bastie (France), Bittar (New Zealand), Czibula (Germany), Corrons (Spain), Dézsi (Hungary), Eppeldauer (USA), Gardner (Australia), Goodman (UK), Kohler (BIPM), Moore (Great Britain), Muray (USA), Pietrzykowski (Poland), Rattunde (Germany), Rastello (Italy), Sauter (Germany), Schanda (Hungary), Wychorski (USA)

**TR:** To prepare a report on the properties of  $V(\lambda)$ -corrected detectors that are suitable for disseminating and maintaining photometric units. This report will include methods for the use of these detectors.

**ST:** Ohno reported. The TC document went through TC ballot (draft 7) in 2004 with no negative votes but several comments, some of which were inconsistent and need to be resolved. TCC is working on these comments and will send a revised draft to the Editor shortly and then send out to TC members again, for a second TC ballot.

### **TC2-39 Geometric Tolerances for Colorimetry**

**Chair:** D. Rich (USA)

**AD:** Johnson

**ML:** Baba (Japan), Bittar (New Zealand), Decarreau (France), Fisch (USA), Hanssen (USA), Jordan (Canada), Johnson (USA), Kravetz (USA), Ladson (USA), Terstiege (Germany), Pietrzykowski (Poland), Verrill (UK), Zwinkels (Canada). Consulting member: Erb (Germany). - revised June 1999.

**TR:** Compile a technical report and recommendations specifying the geometric tolerances for the various geometries in colorimetry, including 0/45, 0/d and others. Parts of this technical report may be suitable for inclusion in a CIE standard specifying several geometric tolerance levels.

**ST:** A written report was received from the TCC, Rich. The final report from TC2-39 has been accepted in Division/BA ballot, but with a long list of comments - mostly editorial in nature from Schanda. Technical comments related primarily to the figures - which a TC member had promised to fix for three years but never did. TCC will attempt to have them re-drawn. TCC has completed about 50% of the work needed to address the comments and editorial changes. After this editing is done, the report will be published.

[Update] The TC report was published as CIE 176:2006 "Geometric tolerances for colour measurements." (2006-12-28)

### **TC2-40 Characterizing the Performance of Illuminance and Luminance Meters**

**Chair:** R. Rattunde (Germany)

**AD:** Sauter

**ML:** Austin (USA), Bastie (France), Peter Blattner (Switzerland), Czibula (Germany), Dezsi (Hungary), Goodman (UK), Khandelwal (India), Khanh (Germany), Mahidharia (India), Ohno (USA), Pietrzykowski (Poland), Saito (Japan), Sauter (Germany), Stolyarevskaya (Russia), Vandermeersch (Belgium), Webb (USA), Xu (Singapore) – June 2006.

**TR:** Convert the present CIE Technical Report No. 69 into an ISO/IEC standard. Prepare a combined CIE/ISO standard describing the definitions of quantities influencing the performance of illuminance and luminance meters, as well as defining measurement procedures for the individual error quantities.

**ST:** Rattunde reported. A fourth draft was prepared and distributed to the members on May 4, 2006. It had already been edited by the Editor. The TC met on June 14 2006 with about 80 participants, with 7 official members (out of 16) present. Draft 4 was presented and discussed. The general contents of the report were agreed. Further actions on technical contents, formal structure as standard and time schedule for completion were discussed. TC agreed to change the term "characteristic" to "index" and the term  $V(\lambda)$  match" into " $V(\lambda)$  mismatch". The draft will be converted into the CIE format for standards using the proper template by the Editor. Email reflector will be setup to discuss final technical details for the draft. The chapter of uncertainties will be left for discussion after receiving the guidelines from DD. A final draft for TC ballot should be ready at the end of this year so that the standard could be finished at the 2007 Beijing meeting. Several new people requested to join the TC, which will be followed up per guidance from DD.

Vandermeersch added that CEN WG 7 Characterization of Illuminance meters and luminance meters has been established to produce a CEN standard. Vandermeersch is the convenor of this WG. He explained that the proposed CEN document will concentrate on giving users advice on how to use the classification and characterization parameters set

out in the TC2-40 document. DD will raise this with Vice President Standards of CIE to avoid duplication and conflict. Hengstberger questioned the general policy on classification of instruments, as he believes all individual parameters are important and overall classification of instruments may be difficult to apply. Rattunde replied that the classification is already in DIN standard and it turned out to be very useful by the users. DD encouraged continued discussion by email reflector.

[Update] The TCC, Reiner Rattunde, passed away in Nov. 2006. Peter Blattner (Switzerland), who has been active in the TC as well as CEN WG7, agreed to take over the chairmanship of this TC, subject to confirmation by D2 and the Board at the Beijing meeting. An email reflector for the TC has been created.

#### **TC2-42** Colorimetric Measurements for Visual Displays

**Chair:** K. Vassie (UK)

**AD:** Johnson

**ML:** Andor (Hungary), Ansell (USA), Baribeau (Canada), Berns (USA), Boyton (USA), Dalton (UK), Hanson (UK), Hardis (USA), Ikeda (Japan), Lara (USA), Laur (Germany), Leone (USA), Lindfors (Finland), Luo (UK), MacDonald (UK), Maelfeyt (Belgium), McFadden (Canada), Ohno (USA), Rastello (Italy), Reid (UK), Sakai (Japan), Schanda (Hungary), Stienstra (Netherlands), Stokes (USA), Vienot (France) – revised June 2001

**TR:** To produce a Technical Report summarizing recommended practice for the measurement of the colorimetric and spectroradiometric properties of visual displays.

**ST:** Goodman reported. Following the proposal last year, Ken Vassie of NPL has taken over the chairmanship from Christine Wall. With many other standards on displays already available (e.g. from SAE, ISO, and VESA), Vassie began by reviewing these and considering again the need for the TC. He noted that CIE is often referred in these standards as the basis for the development of specific methods. The VESA FPDm is currently the key display standard used in the industry, but this document is very much an engineering document. There is a need for more formal and scientifically-precise document for the type CIE is known for, to augment and complement VESA standard. There are also several new standards in emerging OLED, LCD displays, and the TC should review these emerging areas. Vassie suggests that TC2-42 should continue for these reasons, but notes that progress will be over several years. The TC will focus on aspects that are different from other standards and avoid duplicating them. The existing TC draft document will be re-examined and rewritten. It was suggested that cooperation with Division 8 needs to be formalized or maintained.

[Update]: There are some discussions in VESA about how to convert the FPDm document to an international standard. They have formed an “International Committee for Display Metrology” within SID to do this, separate from VESA but with the same group that produced FPDm, and may seek cooperation with international standardizing bodies including CIE. (Secretary, 2007-5-25)

#### **TC2-43** Determination of measurement uncertainties in photometry.

**Chair:** G. Sauter (Germany)

**AD:** Sauter

**ML:** Bastie (France), Corrons (Spain), Daubach (USA), Ellis (USA), Gaertner (Canada), Goodman (UK), Moore (UK), Ohno (USA) - Aug. 2002

**TR:** To prepare a CIE recommendation as the basis for the determination of measurement uncertainties valid for selected quantities used in photometry.

**ST:** Sauter reported. A revised draft was prepared following on from the discussions at the last meeting, and this was used as the basis for Tutorial part of the Symposium just held. The TC document is divided into 3 parts: the first part covers fundamentals (main document), the second part (Annex A) is 15 modules from which more complex uncertainty budgets can be developed, and the third part is examples for modules with Mathematica programs, which are being converted to EXCEL. The document explains that the GUM is good for linear models, but not sufficient in some cases like  $f_1'$ . There is a reference to the Monte Carlo method which is being incorporated into a supplement to the GUM (to be published). The final report should be ready for TC ballot by August.

Hengstberger asked whether specific examples for individual TCs, not covered by this document, should be dealt with in each TC document or in a future revision to the TC2-43 document. An addendum (as in the case of CIE 121) is an option, which will be considered in the future.

Goodman suggested that it seems a much simpler guidance document on uncertainty evaluation is also needed in the industry. Long discussions followed, with pros and cons. Such needs are recognized but there was no consensus to pursue to develop such a document from CIE. Gardner commented that the examples given in this document are at practical levels, but the question is whether the descriptions are at a sufficiently practical level. Sauter will try his best to consider such needs in the final draft.

#### **TC2-44 Vocabulary Matters**

**Chair:** J. Gardner (Australia)

**ML:** Billmeyer (USA), Burghout (Netherlands), Ionescu (Romania), Johnson (USA), Kohler (BIPM), Morren (Belgium), Nishi (Japan), Ohno (USA), Poppe (Hungary), Sauter (Germany), Schanda (Hungary), Woo (Canada) – this list is outdated and to be revised.

**TR:** To provide liaison between D2 and TC 7-06 "Lighting Terminology" and support the preparation of the new edition of the International Lighting Vocabulary in the field of light and colour measurements.

**ST:** Already covered in DD's and Editor's report. Preparation of publication of new ILV version is in progress by CIE CB and VP Jean Bastie. This TC should continue to organize new terms coming out. It was noted that the membership list is outdated. Editor feels that the whole division should be involved rather than members, and will propose a new membership scheme. Any new terms after the new ILV comes out will be collected from new TC documents published after the new ILV.

#### **TC2-45 Measurement of LEDs - Revision of CIE 127**

**Chair:** K. Muray (USA)

**AD:** Sauter

**ML:** Austin (USA), Bando (Japan), Balta (USA), Berkhout (USA), Bouman (Netherlands), Budzinski (South Africa), Bym (USA), Carr (USA), Distl (Germany), Ellis (USA), Fleischer (USA), Gan (Singapore), Goodman (UK), Halkin (Belgium), Heidel (Germany), Jones (USA), Kohmoto (Japan), Larsen (Denmark), Marchl (Germany), Moore (UK), Myers (USA), Ohno (USA), Rastello (Italy), Sauter (Germany), Scarangello (USA), Schanda (Hungary), Solomon (Taiwan), Stolyarevskaya (Russia), Webb (USA), Young (USA) – July 2000.

**TR:** Revise CIE Pub. 127 to include improved definitions of quantities and methods of

measurement for total flux and partial flux of LEDs and to re-evaluate other parts including spectral and color measurements of LEDs.

**ST:** Muray reported. The TC met on June 14, 2006 in Braunschweig. Draft 6 had been circulated for TC ballot from January to March 2006, and was approved by 18 TC members with no negative votes. Numerous comments were received from several members, which were implemented into a final draft, Draft 7a, and distributed to members again, prior to the Braunschweig meeting. After final checking, the draft will be sent for Division and BA ballot.

The TC meeting discussed several outstanding issues that have not been covered in the present document, and thus form the subject for reportership 2-36 (Heidel). These are mainly related to measurements for production control and thermal issues for high power LEDs. See the section of R2-36 for further details.

[Update] The final draft was distributed for Division/BA ballot in September 2006, and closed in December 2006. The document was approved with several editorial comments. TCC and Ohno worked on final editing, with CIE CB. The report was published in March 2007 as [CIE 127:2007 Measurement of LEDs \(2nd ed.\)](#)

#### **TC2-46** CIE/ISO standards on LED intensity measurements

**Chair:** J. Scarangelo (USA)

**AD:** Sauter

**ML:** Angerstein (Germany), Bando (Japan), Bouman (Netherlands), Bym (USA), Carr (USA), Distl (Germany), Ellis (USA), Goodman (UK), Heidel (Germany), Hwang (Taiwan), Jones (USA), Lester (USA), Moore (UK), Ohno (USA), Rastello (Italy), Sauter (Germany), Scarangelo (USA), Schanda (Hungary), Schumacher (Germany)

**TR:** To prepare a CIE/ISO standard on the measurement of LED intensity measurements based on the CIE Pub. 127.

**ST:** Scarangelo reported. The TC met on June 14, 2006 in Braunschweig. The seventh draft was distributed and reviewed. In addition to several editorial and format comments, the meeting focused on several technical issues that still remain. The first of these has to do with how to define more clearly the mechanical axis, in a general way that also covers the small multi-chip and multi-lens LEDs that are included in the scope of the standard. The second issue has to do with the need to specify the LED conditions with respect to temperature and forward current, since these have a major impact on the measurement. For temperature, some members would like to specify a specific  $T_j$  or  $T_a$  and some would like to keep the standard more flexible since  $T_j$  is difficult to measure and a specific  $T_a$  would limit the use of the standard. More discussion and negotiation is needed on this point. The third issue had to do with what to include in an uncertainty guideline section. Some ideas on this were discussed, in particular whether to include temperature in the uncertainty if it is not specified for the measurement. This discussion concluded with the input that we will get an uncertainty guideline to be used by all the TCs and we should wait for that. The last issue is that the document should be reformatted using the template for CIE standards.

#### **TC2-47** Characterization and Calibration Methods of UV Radiometers

**Chair:** open

**AD:** Sauter

**ML:** Boivin (Canada), Hengstberger (South Africa), Wilkinson (Australia), Lambe (UK),



Rattunde (Germany), Saunders (USA), Pietrzykowski (Poland), Corrons (Spain), Larason (USA), Thompson (USA), Kohmoto (Japan), McArthur (Canada), Kravetz (USA) - Aug. 2002

**TR:** Prepare a CIE recommendation on methods of characterization and calibration of broadband UV radiometers in the spectral ranges of UVA and UVB for industrial applications.

**ST:** The former chairman, Gan Xu, resigned in 2004 and the chairmanship has been open since then. The TC has a substantially completed draft and it was felt at previous D2 meetings that it is important to continue this TC. DD Goodman had contacted a few possible candidates, but had not been successful. Armin Sperling of PTB offered at the meeting to take over the chairmanship; D2 voted to approve this change of chairperson with no objections.

#### **TC2-48** Spectral responsivity measurement of detectors, radiometers, and photometers

**Chair:** G. Eppeldauer (USA)

**AD:** Sauter

**ML:** Andor (Hungary), Austin (USA), Boivin (Canada), Bouman (USA), Coutin (France), Dezsí (Hungary), Gardner (Australia), Goodman (UK), Larason (USA), McArthur (Canada), Pietrzykowski (Poland), T Saito (Japan), Sauter (Germany), Webb (USA), Armin Sperling (Germany). Palmer (USA-deceased), Rattunde (Germany-deceased) – updated May 2007.

**TR:** To rewrite the technical report CIE 64 (1984) "Determination of the spectral responsivity of optical radiation detectors" to update device and measurement technology, and include the spectral irradiance and radiance responsivity measurement for radiometers and photometers from UV to near IR.

**ST:** Eppeldauer reported. The TC met on June 14, 2006 in Braunschweig (8th meeting). Draft 9 was distributed prior to the meeting, and discussed at the meeting. The uncertainty sections (3.6 and 3.7) have been expanded and this new information was also presented at the CIE Expert Symposium in a talk by Eppeldauer. Chapter 6 has been modified: only the recommendations relating to calibration now remain in the main text and information on instrumentation has been moved to the Appendix. A subsection on bandpass effects and corrections has also been added to this chapter. In the Appendix, a subchapter on the bandwidth normalization by moments has been removed. The references are now complete. Editor has started editing the document in CIE style. Some contributions to the uncertainty chapter from PTB (Sauter and Stefan Winter), are expected. Some more minor corrections and additions to improve the document further are expected before the final editing.

#### **TC2-49** Photometry of Flashing Light

**Chair:** Y. Ohno (USA)

**AD:** Vandermeersch

**ML:** Andersen (USA), Austin (USA), Berkhout (USA), Couzin (USA), Ellis (USA), Eppeldauer (USA), Fryc (Hungary), Gibbs (UK), Goodman (UK), Hengstberger (South Africa), King (USA), Orrevetellainen (Finland), Rennilson (USA), Sagawa (Japan), Schmidt-Clausen (Germany), Sauter (Germany), Tutt (UK), Vienot (France), Webb (USA). Rattunde (Germany-deceased) – updated May 2007.

**TR:** Produce a technical report for photometric measurements of flashing light, including derivation of the photometric quantities applied to flashing light, measurement of light

sources, and calibration of photometers for flashing light.

**ST:** Ohno reported. Progress has been slow, since the TC is still waiting for visual evaluation data. However the TCC wants to try to finish the rest of the document, as there is a strong desire to standardize one method for effective intensity. He mentioned that NIST has established a Vision Science project, within which it is planned to carry out some effective intensity experiments in a few years time. A guest researcher to work on such experiments would be welcome. Tutt said that he had attended an IALA conference in China at which relevant papers were presented. He will send the proceedings.

DD asked TCC to try to finish the document except for the remaining issue. One option might be to separate effective intensity issue and finish the document only on physical measurement part. The TCC will try to follow that route.

#### **TC2-50** Measurement of the optical properties of LED clusters and arrays

**Chair:** G. Schuette (Germany)

**AD:** Vandermeersch

**ML:** Ashdown (USA), Sperling (Germany), Gibbs (UK), Ikonen (Finland), Distl (Germany), Goodman (UK), Hai (Malaysia), Heidel (Germany), Kohmoto (Japan), Mathe (Germany), Muray (USA), Ohno (USA), Pan (China), Rattunde (Germany), Navvab (USA), Sauter (Germany), Steudtner (Germany), Scarangelo (USA), Stolyarevskaya (Russia), Young (USA) – revised May 2005

**TR:** To produce a technical report for the measurement of optical properties of visible LED arrays and clusters, to derive optical quantities for large LED arrays and recommendations for measurement methods and conditions.

**ST:** Schuette reported. The TC met on June 14, 2006 in Braunschweig with 64 participants. A first draft (Draft 1B) was distributed to members prior to the TC meeting. The meeting discussed definitions of some basic terms (modules, clusters, and arrays), how to measure photometric quantities (luminance, luminous flux, etc.) and how to describe uniformity in color (input from D1 suggested). It was requested that anybody with knowledge from other documents on definitions of terms e.g., in ISO, should contact the TCC.

#### **TC2-51** Calibration of multi-channel spectrometers

**Chair:** R. Austin (USA)

**AD:** Johnson

**ML:** Goodman (UK), Hopkinson (UK), Prince (UK), Pietrzykowski (Poland), Smith (USA), Bergman (USA)

**TR:** Produce a technical report for the calibration of array spectroradiometers primarily for the determination of colorimetric and photometric quantities, including sources of error in array spectral measurements systems, evaluation of these errors, calibration methods and methods for the determination of uncertainty. (Revised in 2003)

**ST:** No report received this time. DD will ask TCC for update on this TC. If the TC keeps inactive, a new chairperson might be appointed. Peter Sperfeld was interested to take this on. Goodman mentioned a joint NPL-SIRA document on multi-channel spectrometers, produced several years ago, which could be used as a starting point. Hengstberger mentioned that a bibliography was produced before (though not published and probably outdated), which might also be looked at.

**TC2-52** Addendum to CIE 121 for the Photometry of Emergency Lighting Luminaires

**Chair:** G. Vandermeersch (Belgium)      **AD:** Vandermeersch

**ML:** Corrons (Spain), Ottosson (Sweden), Rattunde (Germany), Stratford (UK), Weiss (Germany), Bedocs (UK), Rossi (Italy), Price (UK, until 1/3/2003), Arens (USA, until 1/1/2002) - updated July 2003

**TR:** To produce an addendum to CIE publication 121 containing specific requirements for the photometry of emergency lighting luminaires, in particular to provide additional correction factors on the relative output of the luminaires at specified times of operation.

**ST:** Vandermeersch reported. The draft document is ready to be sent to Editor prior to TC ballot. This document introduces methods for EBLF measurements on ballasts. The new concept of EBLF has been now accepted worldwide by emergency ballast manufacturers following the publication in October 2006 of IEC standard 61347-2-7 "Particular requirements for D.C. supplied Electronic ballasts for emergency lighting"

**TC2-53** Multi-Geometry Color Measurements of Gonio-apparent Materials and Metrics for Evaluation

**Chair:** G. Roesler (Germany)      **AD:** Johnson

**ML:** Pointer (UK), Naddal (USA), Pietrzykowski (Poland), Andor (HU), Rastello (Italy), Gunde (SI), Fryc (Poland), Rodrigues (USA), Nofi (USA), Rich (USA), Dauser (Germany), Gabel (Germany), Cramer (Germany), Baba (Japan), Carter (USA), VanAken (USA) - April 2003

**TR:** Write recommendations for the color measurement of effect materials. Workplan: (i) Comparison of the DIN and ASTM standards on Multigeometry color measurement; (ii) Preparation of an educational section to combine most interests; (iii) Recommendations from the educational section for the next meeting.

**ST:** Roesler reported. The TC met on June 15, 2006 in Braunschweig. A recommendation on angle notations proposed last year (to use angle relative to normal) was sent to ASTM, which they accepted. There was a question on the general CIE method of describing angles. DD clarified that relative to normal is the general convention, and it is in 2-39 document, which is now in Division ballot stage and close to publication. It was noted that activity continues in ASTM and DIN committees on the subject of this TC, with many common members from TC2-53. The draft report of TC2-53, which is now in accordance with the CIE template, has been distributed to members. The TC discussed additional contents for the report - normative references, requirements for calibration, instrument parameters, etc. Development of metrics will take some time, and the TC plans to publish a first report without metrics as Part 1, and Part 2 for metrics. It was suggested that a change of TR could be considered as an alternative method by which to narrow the scope of document. The TCC is advised to send a draft to Editor when it is substantially completed.

**TC 2-56 (S)** CIE/ISO standard on retroreflection measurements

**Chair:** C. Miller (USA)      **AD** Johnson

**ML:** Johnson (USA), Stratford (UK), Jenkins (Australia), Sorenson (Denmark), Rastello (Italy), Ledoux (France), Frank (Germany)

**TR:** To prepare a CIE/ISO standard on the measurement of retroreflective materials based on CIE Publication 54.2

**ST:** Miller reported. The TC met on June 14, 2006 in Braunschweig and reviewed the current draft. The definitions and measurement geometries were approved at the meeting. Much of the time was spent discussing the different measurement techniques available. The group agreed that different measurement techniques should be allowed if they can be shown to produce equivalent results. TCC agreed to perform experiments to resolve these differences in his facility at NIST. The TC members will communicate through email until the next meeting in Beijing.

#### **TC2-57 (S) Revision of CIE S014-2**

**Chair:** A. Robertson (Canada) **AD** Johnson

**ML:** Bristow (Sweden), McGinley (Austria), Zwinkels (Canada), Rich (USA), Schanda (Hungary), Pointer (UK), Hirschler (Hungary), Ohno (USA) – updated May 2005

**TR:** To revise CIE Standard S014-2 (Colorimetry Part 2: CIE Standard Illuminants) to include Illuminant D50.

**ST:** A written report was received from the TCC, Robertson. The TC was established at the 2003 D2 meeting in San Diego on the understanding that it would not start work until the current revision of S014-2 was completed. In October 2005, the CIE Central Bureau sent the latest draft of this current revision (CIE DS 014-2.3/E:2005) to NC for a letter ballot with a deadline of 2006-02-02. Once final approval is achieved, TC 2-57 will begin its work. DS 014 has only a few editorial issues to take care of and will be published very shortly.

#### **TC2-58 Measurement of LED radiance and luminance**

**Chair:** K. Kohmoto (Japan) **AD** Sauter

**ML:** Horak (Germany), Sliney (USA), Muray (USA), Goodman (UK), Ohno (US) + others to be agreed

**TR:** To prepare a CIE Technical Report setting out recommended measurement methods for the luminance and radiance of LEDs, taking particular account of the specific requirements of relevant photobiological safety standards

**ST:** Kohmoto reported. TC met on June 15, 2006 in Braunschweig (3<sup>rd</sup> meeting), attended by 51 persons. The TC reviewed previous meetings. This TC is for single chip LEDs, not including modules and arrays. The TC discussed table of contents, selection of terms for the definition section. The future action plan is to complete a 2<sup>nd</sup> draft and circulate it to members by the end of 2006. Members were requested to review and submit comments to the chairman by the end of March 2007. It was mentioned that TC6-55, chaired by W Horak, is investigating photobiological safety risks of LEDs. This TC will meet in September 2006 in Ottawa, and has invited TC2-58 members to attend. TC2-58 plans to have its next meeting in Beijing.

#### **TC2-59 Characterisation of Imaging Luminance Measurement Devices**

**Chair:** P. Blattner (Switzerland) **AD:** Sauter

**ML:** To be finalised

**TR:** To prepare a Technical Report on methods for the characterization of imaging luminance measurement devices.

**ST:** Blattner reported. The TC met on June 15, 2006 in Braunschweig, with 54 participants. Draft 0.3 was presented and discussed. The TC agreed on the structure of the document.

There was a discussion about the model to be included in the Technical Report. Some preferred a "black box" approach, others like to have access to raw data so the calculations and evaluation can be done independently of the manufacturer. Manufacturers need to be able to provide characteristic indices of performance, but users need to be able to know how the data evaluation has been done in order to establish an uncertainty budget. There was a general agreement on having a mixed approach, including a chapter on the physical (internal) model of ILMDs. TCC will prepare Draft 1.0 for the next meeting (to be held in Beijing, July 2007) with the help of different coauthors. Feedback from members, who are willing to contribute, is requested.

[Update] With passing of Reiner Rattunde, Blattner has taken over the chairmanship of TC2-40. He will work on TC2-40 with higher priority, and thus, TC2-59 work will be delayed unless a new chairman can be found.

**TC2-60** Effect of Instrumental Bandpass Function and Measurement Interval on Spectral Quantities

**Chair:** D. Gibbs (UK)

**AD:** Sauter

**ML:** Guenther (Germany), Ohno (USA), Robertson (Canada), Saito (Japan), Sauter (Germany), Schanda (Hungary), Sperling (Germany), Steudtner (Germany), Kohmoto (Japan), Hai (Malaysia), Zwinkels (Canada), Bastie (France), Scarangelo (USA), Young (USA), Woolliams (UK), Goodman (UK) – Feb. 2006

**TR:** To prepare a technical report that describes the effect of instrumental bandpass functions and measurement wavelength interval on spectrally resolved quantities and provide recommendations on suitable methods to minimize the error introduced by instrumental bandpass functions on spectrally integrated or weighted quantities.

**ST:** The Secretary received a letter from the TCC, David Gibbs, who has resigned as the TC chair, as he was assigned to a role within NPL that is outside the field of optical radiation metrology. Gibbs thanked all the members of the CIE for the friendship that has been extended to him since his involvement with the CIE. Emma Woolliams of NPL offered to take over the chairmanship of the TC. Emma explained that she recently worked on bandpass correction, as presented at the Uncertainty Symposium. The change of chairmanship was approved unanimously.

[Update] An email reflector was created after Braunschweig meeting, and has been very actively used. All members have been confirmed and introduced, and Woolliams produced a first draft 1.0, with members then taking turns to add more contents. Draft 2.0 has been done by Gardner, and 2.1 by Schanda.

**TC2-61** Spectral and Colorimetric Electronic Data Exchange

**Chair:** M. Pointer (UK)

**AD:** Vandermeersch

**TR:** To write a Technical Report to define a specification for the electronic communication of spectral and colorimetric data from measuring instruments.

**Chair:** Mike Pointer (UK)

**ML:** Coetzee (ZA), Dornan (UK), Rhodes (UK), Roesler (DE), Young (US), Vik (CZ)

**ST:** DD Goodman reported. This TC was established in 2005 to progress the work that ISO TC38 Textiles originally instigated but declined to forward, using the argument that it

was too generic to fit within their remit (textiles). Since then ISO TC 38 has reversed its decision and is now to progress the work via a Working Group and it has therefore become unnecessary for CIE to work on it. D2 agreed, with no objection, to close this TC, and instead, establish a reportership to keep liaison with ISO TC 38. The details of the reportership will be formalized later.

## **8.4 Reporters**

### **R2-23 ISO/CIE Standards for the measurement of reflectance and Transmittance**

**Reporter:** D. Rich (USA)

**AD:** Johnson

**TR:** To investigate the need for converting the CIE technical report on reflectance and transmittance measurement (CIE 130) to a joint ISO/CIE standard

**ST:** A written report was received from Rich. There have been no new standards on the measurement of reflectance and transmittance, nor have there been significant advances in any D2 TCs that may require the development of a standard. ISO 13655, on the measurement of the reflectance and color of printing, is under revision, extending their recommendation to include both a matte black backing and a matte white backing. ISO 5 series has been completely revised with new, clearer specifications of the requirements for density using spectral reflectance or transmittance measurements and numerical conversion to ISO Status Density (transmission density or reflection density). The series is schedule to go to ballot this fall. Rich recommends continuation of this reportership. (Full report is in **Attachment 2**).

### **R2-28 Evaluation of Colorimeter Spectral Responsivity**

**Reporter:** B. Kranicz (Hungary)

**AD:** Sauter

**TR:** To review new methods for assessing the ‘quality-of-fit’ of the spectral responsivity of colorimeters, particularly for use with new sources such as LEDs.

**ST:** No report received. AD Sauter to contact the reporter for updates for activity report.

### **R2-32 Visual Appearance Measurement**

**Reporter:** M. Pointer (UK)

**AD:** Johnson

**TR:** To monitor the work of Divison 1 on visual appearance measurement, which will include potential new measurement areas

**ST:** DD Goodman reported. The technical work in this area is primarily in TC1-65 Measurement of Visual Appearance. In April 2006 TC1-65 submitted a draft technical report for ballot by the Division and the CIE BA. This report sets out basic building blocks for evaluation of visual appearance of materials, that is, color, gloss, translucency, and texture. It describes what is currently known and what is not, and suggests further research areas to address. There will also be a CIE expert symposium on visual appearance in Paris later this year. A detailed written report from M Pointer was also received, which is attached in **Attachment 3**.

### **R2-33 Measurement of Laser-Based Projection Displays**

**Reporter:** K. Niall (Canada)

**AD:** Sauter

**TR:** To describe concepts and methods of photometry for the comparison of laser-based projection displays.

**ST:** No report received. Zwinkels to contact the reporter or D1D to update the status.

**R2-34 Methods for Characterising and Calibrating Detectors in Photon Counting Regime**

**Reporter:** M. L. Rastello (Italy)

**AD:** Sauter

**TR:** To consider the emerging requirements for characterisation and calibration of detectors in the photon counting regime.

**ST:** DD Goodman reported, based on a written report from Rastello. As announced in Leon, SPW-05, Single Photon Workshop 2005, was held at NPL last year. The main topics were single photon sources, single photon detectors, low photon sources, and new equipment. More than 80 people attended the meeting, 54 % from UK, 16 % from USA, and remainder from the rest of the world. There are two new workshops are planned in the area of single photon metrology for the future. SPW-07 will be held at IEN in Italy in October 2007, linked with a workshop for an EU contract, called Symphonia, which is concerned with single photons. SPW-09 will be held at NIST in 2009. The EUROMET Photometry and Radiometry group has prepared a roadmap, entitled "Towards quantum photon based standards" which will be included in the forthcoming European Metrology Research Program. Within this particular roadmap, photon techniques are considered to be powerful tools for standards in the field of photonics and communication. A definite interest in these techniques will be registered in photobiology and photochemistry as well. Rastello proposes to continue the reportership for the time being, with a longer-term probable objective to start a TC relating to calibration of photon counting systems.

**R2-36 Measurement requirements for solid state light sources**

**Reporter:** G. Heidel

**AD:** Sauter

**TR:** To investigate the need for guidelines and recommendations relating to the measurement of LEDs, OLEDs and other solid state light sources that are not covered by other CIE Publications or TCs. Specific aspects to be considered include guidance for production areas, high brightness LEDs (e.g. pulsed operation and temperature control) and detector qualification ( $f_1$  etc.).

**ST:** Heidel reported. Based on discussions at the TC2-45 meeting on June 14, there are a number of issues that are not covered in the revision of CIE 127. The issues include measurement of high power, large area LEDs and chips, related thermal problems not experienced with low current LED lamps (pulse measurement and temperature conditions), and measurement of LEDs in production environments where high speed is required with strictly limited space and correlation with laboratory measurement is difficult. In particular, the measurement of partial flux and total flux in production testing is a problem.

A lengthy discussion followed and a wide range of issues were raised. Many participants agreed that thermal issues for high power LEDs need be addressed urgently. Others commented CIE should not address production testing issues, although this view was opposed by some. There was no resolution from the discussions. DD proposed that Heidel prepares a written summary of issues he presented, including input from anyone else wishing to contribute (this input should be sent to Heidel directly), and that he should prepare an action proposal based on this for discussion at the next meeting.

## **R2-37 Industrial lighting requirements for a D65 illuminant**

**TR:** To investigate the requirement for a specification for a practical D65 source for use in industry, particularly the lighting industry.

**Reporter:** E. Pierson AD: Vandermeersch

**ST:** Pierson reported. A two-page report (**Attachment 4**) has been submitted to Secretary. He contacted Robert Hirschler, the chair of TC1-44, Janos Schanda, the chair of TC1-66 Indoor daylight Illuminant, and also manufacturers of sources including Hunterlab and GretagMacbeth. His findings are that systems simulating D65 are commercially available but they are mainly for diffuse geometry and integrated systems, and sources for D65 are not separately available. The CIE rating method (51.2-1999) is not yet widely used. EN12899 requires that chromaticity coordinates of road vertical signs be measured using a D65 illuminant, but the rating of the source is not mentioned. In conclusion, Pierson recommended that the CIE rating should be used systematically not only in other standards but also by manufacturers that produce such sources; and also that the technical report from TC1-44 should be published as soon as possible. This TC has been established for more than 10 years but there has not been much progress recently. He proposes no further actions on this reportership.

Some discussions followed. There were several comments suggesting investigation of other aspects, including some new types of tunable sources available (using LEDs and digital micro mirror devices), flash sources used in cameras for color reproduction (relation to D8), the need for definition of practical day light source that can be more easily realized, etc. It was also mentioned that the reference to the lighting industry in TR for this reportership was confusing. In conclusion, DD is to contact D1D to convey that D2 is anxious to have the report of TC1-44 published soon. It was agreed that this reportership be kept one more year to explore the issues raised at this meeting and to prepare a final report and proposal for the next meeting.

## **8.6 Liaisons with other organizations**

### **CCPR - Comité Consultatif de Photométrie et Radiométrie (Y. Ohno)**

Ohno reported. CCPR meets once every two years in Paris, with the last meeting in October 2005 and the next meeting in June 2007 just before the CIE Session in Beijing. President of CCPR is F Hengstberger. There are a number of Working Groups which meet every year; the next WG meeting will be October 2006 in CENAM, Mexico. These WGs are: Key Comparisons (chair, Ohno), Calibration and Measurement Capabilities (chairman rotates), UV (chair, Ikonen), and Strategic Planning (chair Hengstberger). WG-CMC consists of RMO Photometry and Radiometry TC chairs, working to maintain service categories of the BIPM CMC tables, etc. WG-SP was created at last meeting to discuss long-term plans and general issues for CCPR activities. A big issue in WG-KC is to plan for the next round of KCs and to establish some strategies in relation to RMO comparisons, as the CCPR KCs have increasing numbers of participants and becoming difficult to conduct. There are several KCs still in progress (see **Attachment 5**).

### **Division 8 (A. Kravetz)**

No report this time.



**ISO TC6/WG3 Paper, board & pulps – optical properties (J. Zwinkels)**

Zwinkels reported. The next meeting of ISO TC6 is in Atlanta, GA (USA), Nov. 12-17, 2006. In August 2005, Byron Jordan (Canada) commenced his term as the new Convenor of this working group. There has been increasing recognition of the importance of having terminology in more strict accordance with CIE definitions. WG3 is responsible for 12 standards on reflectance measurements. The ISO Standards on colour methods have been renumbered under ISO number 5631. Thus, the following ISO standards: 5631, 16692 and 20312 have been renumbered to 5631-1, 5631-2 and 5631-3, respectively. ISO 5631-2 Paper and board – Determination of Colour – outdoor daylight conditions (D65/10°) is at the CD (committee draft) stage. ISO 5631-3 Paper and board – Determination of Colour (D50/2°) Diffuse Reflectance Method has been submitted for CD ballot. ISO 2471 Paper and board – Determination of opacity (paper backing) – diffuse reflectance method has been revised and is at the DIS stage. TC6 has liaisons with CIE, ISO TC130 Graphic arts, and ISO TC38 Textiles. A full written report from Zwinkels is in **Attachment 6**.

**IEC TC34 Lamps and related equipment (G. Vandermeersch)**

No report this time.

**ISO on reflectance and transmittance issues (D. Rich)**

A written report was received from Rich. The ISCC held a successful symposium on reflectance measurement in imaging last fall after the IS&T Color Imaging Conference. The level of agreement between commercial spectrophotometers is not adequate to provide unambiguous characterization of digital printers and commercial printing presses. The need for more reliable diffuse reflectance measurements was raised during the recent CIE Division 1 meetings in Ottawa. New scanning spectrophotometers are becoming very popular but they provide a non-contact measurement of diffuse reflectance by placing the instrument a few millimeters above the surface of the specimen and this configuration is not covered by any international convention. Rich does not believe that non-contact diffuse reflectance has been addressed in any D2 publication - though he has not made an exhaustive search of our publications on the optical properties of materials. Methods for evaluating uncertainty in the measurement of the total radiance factor using polychromatic influx that approximates a CIE standard illuminant is becoming a very critical need.

**IDA (J. Rennilson)**

No report received.

**OIML (G. Sauter)**

Sauter reported. There are no issues to be reported this time. Keep this function open.

**IALA (International Association of Lighthouse Authorities) (C. Andersen/ I. Tutt)**

Secretary reported showing a presentation received from Tutt. There was a 16<sup>th</sup> IALA conference in China in May 2006, titled “Aids to Navigation in the Digital World”. Topics of interest covered in this conference were: LED Precision Sector Lights, Visual Experiments with Flashing LEDs (France), Visual Experiments with Flashing LEDs (Japan), Conspicuity of Marine Signal Lights (UK), Measuring Pulsed LEDs (UK), Proposed IALA Colour Regions for Signal Lights (Poster). Proceedings of these papers will be obtained and can be shared.

IALA has a special Working Group on Lights and Colours, working on issues such as colour of signal lights, luminous intensity and range, measurement, and methods for calculating performance.

**IEC TC100 (Color measurement and management in multimedia systems) (D. Rich)**

There have been only simple maintenance activities. (Rich, 2006-6-9)

**9. Proposals for dissolution of TCs and reporterships**

- TC2-61 to be closed. (See the section on TC2-61 above)

**10. Proposals for new TCs and reporterships**

- A reportership to replace TC2-61 will be formalized. (See the section on TC2-61 above)

Changes in TCs and reporterships

- The chair of TC2-47 changed to Armin Sperling (Germany).
- The chair of TC2-60 changed to Emma Woolliams (UK).
- The chair of TC2-28 changed to Teresa Goodman (UK).

**11. General issues**

**11.1. Future D2 Symposia**

- (1) Follow-on symposium on LED measurements: The last symposium on this topic was in 2004, Tokyo. It was agreed to plan a two-day symposium possibly for 2007, not linked with CIE Beijing, but combined with some other meeting. CORM was suggested. The plan will be finalized via email communication.
- (2) Third symposium on uncertainties: The second symposium on this topic has just been held in Braunschweig. It was suggested that another symposium be scheduled some time after the TC2-43 report is published, in 2008 or after.
- (2) Follow-on symposium on pulsed source and temporal aspects: This is not urgent at the moment, and will be considered for a longer timescale, 2009 or after.

**11.2. Future Directions for Measurement R&D**

It was agreed that this should continue to be considered within D2 in the future. The list of topics from the last couple of meetings is still valid. If anyone has additional items to add to the list, they should let DD know by email.

**12. Future D2 Meetings:**

**2007:** July 9-11, with Quadrennial Session in Beijing, China

**2008:** An offer has been made from IEN, Italy. Another option was in conjunction with NEWRAD 2008 in Korea. D2 voted by majority to meet in Italy in 2008.

**2009:** Open. Discuss next year.

### **13. Any Other Business**

No further issues were raised.

### **14. Adjournment**

Goodman expressed her big thanks to G Sauter, A Sperling, Sabine Rodrigues, and other PTB staff members for hosting the Symposium and D2 meetings in Braunschweig. This was enthusiastically supported by all present. The meeting adjourned at 5:00 PM.

**Attachment 1** Agenda of 2006 Div.2 Meeting

**Attachment 2** Report of R2-23 ISO/CIE Standards for the measurement of reflectance and transmittance (Rich)

**Attachment 3** Report of R2-32 Visual appearance measurement (Pointer)

**Attachment 4** Report of R2-37 Industrial lighting requirements for a D65 illuminant (Pierson)

**Attachment 5** Report of Liaison - CCPR (Ohno)

**Attachment 6** ISO TC6/WG3 Paper, board & pulps – optical properties (Zwinkels)

# **2006 Division 2 Meeting**

## **Braunschweig, Germany**

**09:00, 16 June 2006**

### **Agenda**

1. Attendance list, apologies
2. Introductions
3. Approval of agenda
4. Approval of the minutes of 2005 Division meeting
5. Director's report
6. Secretary's report
7. Editor's report
8. Progress reports from Technical Committees, Reporters and Liaison Persons
  - 8.1. Associate Director Sauter and TC chairpersons
  - 8.2. Associate Director Vandermeersch and TC chairpersons
  - 8.3. Associate Director Johnson and TC chairpersons
  - 8.4. Reporters
  - 8.5. Liaisons with other Divisions
  - 8.5. Liaisons with other Organisations
9. Proposals for dissolution of TCs and reporterships
10. Proposals for new TCs and reporterships
11. General issues
  - 11.1 Future D2 Symposia
  - 11.2 Future directions for measurement R&D
12. Future meetings
  - 12.1 2007
  - 12.2 2008
  - 12.3 2009
13. Any other business
14. Adjournment

## Attachment 2

### **Report on R2-23 ISO/CIE Standards for the measurement of reflectance and Transmittance**

There have been no new standards on the measurement of reflectance and transmittance. Nor have there been significant advances in any Division 2 Technical Committees that may require the promotion of a Technical Report to the development of a standard.

ISO 13655 on the measurement of the reflectance and color of printing is under revision. One problem with which they continue to struggle involves the measurement of the reflectance of non-optically thick materials, where the measurement radiance may propagate horizontally away from the measurement aperture or through the specimen and be reflected from the backing into the measurement aperture. Currently, ISO 13655 has extended their recommendation to include both a matte black backing and a matte white backing. They are also in the process of recommending a defined configuration for making a VIS only spectral reflectance factor measurement by defining a UV-blocking filter to be placed between the light source and the specimen. This is required because most graphic arts papers contain significant amounts of fluorescent whitening agents.

ISO 5 series has been completed revised with new, clearer specifications of the requirements for density using spectral reflectance or transmittance measurements and then numerical conversion to ISO Status Density (transmission density or reflection density). The series is schedule to go to ballot this fall.

There is a need to continue to monitor the advances of the ISO and CIE looking for the opportunity to set up a TC to develop a standard on the measurement of spectral reflectance (either regular or diffuse) and transmittance (either regular or diffuse).

Respectfully submitted,  
Dr. Danny C. Rich

(Received from Danny Rich, June 9, 2006)

## Attachment 3

### Reporter R2-32 Visual appearance measurement

In April 2006 TC 1-65 Visual Appearance Measurement submitted a draft technical report for ballot by the Division and the CIE Board of Administration. This summary of the report is as follows:

#### **A FRAMEWORK FOR THE MEASUREMENT OF VISUAL APPEARANCE**

Visual appearance can be one of the most critical parameters affecting customer choice and it needs, therefore, to be quantifiable to ensure alone; other attributes of the material from which it is fabricated contribute to uniformity and reproducibility. A starting point in assessing the appearance of a consumer product might be the measurement of its colour. A description of its total appearance, however, cannot be achieved by the definition of colour the overall appearance.

Starting from a definition of soft metrology and a description of measurement scales, this report describes a framework on which a set of measurements could be made to provide correlates of visual appearance. It will be shown that the interactions between the various components of the framework are complex, that physical parameters relating to objects are influenced, at the perception stage, by the physiological response of the human visual system and, in addition by the psychological aspects of human learning, pattern, culture and tradition.

The result might be to conclude that an attempt to measure appearance may be too bold a step to take. Thus, a sub-framework is considered in terms of what can now be measured, and what might be measured after further investigation and research. By dealing with the optical properties of materials it is seen that there are, perhaps, four headings under which possible measures might be made: colour, gloss, translucency and texture. It is recognised that these measures are not necessarily independent; colour may influence gloss, colour will certainly influence translucency, and texture is probably a function of all three of the other measures.

Colour measurement, colorimetry, is based on the measurement of spectral reflectance, and is an established science that is possible using commercial instrumentation available at reasonable cost. Two shortcomings are identified. First, there are a number of modern materials where colour measurements made using a single pair of illumination/viewing angles is not sufficient to describe the perceived colorimetric effect. Thus, measurement at more illumination/viewing angle combinations is required. Second, the traditional, CIE recommended colorimetric parameters, while providing correlates of visual percepts, are not able to predict the absolute appearance of a coloured sample: colour appearance models are now able to do this.

The measurement of gloss is an established methodology but there is some doubt as to the scientific basis for making the measurements using the present method and attempts are being made to define alternative approaches. The extension of gloss measurement, which is essentially a measurement made at a specific angle depending

on the apparent gloss of the sample, to investigate the shape of the gloss peak, should provide more information.

Translucency is a subjective term that relates to a scale of values going from total opacity to total transparency. This whole subject area needs investigation to find a rigorous measurement solution that will probably be industry specific.

Texture is a harder variable to measure. The advent of digital imaging systems makes the acquisition of images of materials relatively easy, assuming due consideration is given to the resolution of the image capturing device, be it a camera or a scanner. Characterising these images to give accurate CIE based colorimetry is now possible and the application of suitable analysis software should be able to provide measurement scales that relate to the perceived texture. The idea of establishing a series of 'standard' textures has been suggested.

The final section of the report describes a number of opportunities for future work and I would be happy to forward a copy of the report to anyone who is interested.

M R Pointer  
Apr-2006

## Attachment 4

### **R2-37 Industrial lighting requirements for a D65 illuminant**

*Report to CIE Division 2, June 2006*

Etienne PIERSON

Laborelec, Belgium

#### **Terms of Reference**

To investigate the requirement for a specification for a practical D65 source for use in industry, particularly the lighting industry.

#### **Background**

There is a need for recommendation on practical realization of a D65 source. This has also been discussed in D1 since no recommendation is given in CIE15:2004 for a physical D65 source. This is needed not only for colorimetry but also other applications such as road traffic signs measurements. A comment was made that high power source to simulate daylight is also needed in the photovoltaic area.

There has already been a lot of work concerning this topic, among others a reportship in D1 some time ago, looking at feasibility of such recommendation as there were approaches using filters. A TC was later set up (TC1-44 "Practical Daylight Sources for Colorimetry"), chaired by Robert Hirschler, which went more towards assessing daylight simulators. There are two publications in Appl. Opt. on a D65 simulation source based on a xenon lamp. Finally, a new TC has been started in D1 concerning Indoor daylight:

TC 1-66: Indoor daylight illuminant, chaired by Janos Schanda

Terms of Reference: To prepare a CIE recommendation on an Indoor Daylight Illuminant and a corresponding Indoor Daylight Source, considering the needs of the partner international standards organizations.

#### **Discussion**

It appears that the Terms of Reference of this reportship are very close to that of TC1-44 "Practical Daylight Sources for Colorimetry" chaired by Robert Hirschler, in which a lot of information about commercially available sources has already been gathered since the TC was formed in 1995. The final report of this TC is however not yet available.

According to Robert, there are some options which are - or were until recently - commercially available. The problem is that most of the instruments with a good D65 simulator (filtered Xenon) have diffuse geometry, which is not really recommended for fluorescent samples and is considered totally inadequate for retro-reflecting ones. The only instrument with a good flashes Xenon daylight simulator (at least as regards the UV/visible ratio) seems to be the Labscan XE of Hunterlab. However, this is an integrated instrument including both source and detector with a fixed geometry (it actually uses a 0/45 geometry, not a 45/0). So it seems that a separate source is not commercially available.

Robert also concludes that standardizing a source (ANY source) is not a solution because if you do it for the measurement, it may or may not comply with the visual evaluations (using a



different source) - and then what good is a measurement? It is an extremely complex problem with very limited real-life solutions

### **CIE rating**

In order to be able to evaluate the quality of a source, CIE published a rating method (CIE 51 : A-A, A-B, B-B, ...) in 1981, revised in 1999 as CIE Technical Report 51.2-1999, but this method is not widely used yet. As an example, the rating of the Labscan of Hunterlab is not yet available. At this point in time the manufacturer can only give a CIE rating for the latest developed Ultrascan Pro. Hunterlab has started a program to adapt different instruments to this rating advise of CIE but this will take more time.

It must also be pointed out that the information given by the manufacturers can sometimes be misleading. For example, some commercial documents from GretagMacbeth seem to indicate that they have several sources meeting all major standards such as ASTM D1729, including a filtered tungsten source (the Sol Source). However only the booths (such as the SpectraLight booth) can indeed simulate daylight as Category AB according to CIE 51 (i.e. it complies with the ASTM D 1729 both in the visible and in the UV). This can be achieved by using a small additional fluorescent tube to enhance the UV content of filtered tungsten. The Sol Source does not come with UV enhancement and thus its rating is only given for the visible range, not for UV.

### **Measurement uncertainty**

A related problem is the calculation of the measurement uncertainty when performing a colorimetric measurement. According to Robert Hirschler, it is at least as uncertain as the realization of the source itself. ASTM and ISO speak of "Category BB" (CIE 51 method) being in many cases acceptable, but it seems that there are no data on retro-reflecting fluorescent samples.

### **Standards**

Contrary to what was said during the 2005 D2 meeting (and reported in the minutes), measurement of phantom effects for signals do not explicitly require a high power D65 simulated source but other standards such as EN 12899-1 (road vertical signs) ask that chromaticity coordinates and luminance factor be measured with a D65 illuminant. However, the rating of the source is not mentioned.

### **Conclusions and recommendations**

We can only recommend that

- TC1-44 complete its work as soon as possible and publish the final report with recommendations for practical daylight illuminants; this work should also be continued as long as new sources become available on the market
- manufacturers of D65 sources use the CIE ratings in a systematic way
- the required CIE rating be also indicated in standards requiring a D65 illuminant.

We propose to close this reportship.

## Attachment 5

### **Liaison Report – CCPR (Consultative Committee for Photometry and Radiometry)** Y. Ohno

#### List of Key Comparisons

CCPR K1.a	Spectral irradiance (250-2500 nm)	complete
CCPR K1.b	Spectral irradiance (200-400 nm)	in progress
CCPR K2.a	Spectral responsivity (900-1600 nm)	Draft A2
CCPR K2.b	Spectral responsivity (300-1000 nm)	complete
CCPR K2.c	Spectral responsivity (200-400 nm)	in progress
CCPR K3.a	Luminous intensity (cd)	complete
CCPR K3.b	Luminous responsivity (A/lx)	complete
CCPR K4	Luminous flux (lm)	complete
CCPR K5	Diffuse spectral reflectance	report in progress
CCPR K6	Regular spectral transmittance	report in progress

#### <Supplementary Comparisons>

CCPR S1	Spectral radiance	report in progress
CCPR S2	Aperture area	Draft B
CCPR S3	Cryogenic radiometer	complete

\* No further supplementary comparisons will be conducted under CCPR.

For further information, visit CCPR website:

<http://www.bipm.fr/en/committees/cc/ccpr/>

## Attachment 6

### ISO TC6/WG3 Paper, board & pulps – optical properties (J. Zwinkels)

The following recent activities may be of interest to the CIE:

The next meeting of ISO TC6 is in Atlanta, GA (USA), Nov. 12-17, 2006. In August 2005, Dr. Anthony Bristow submitted his final report to ISO/TC6 on the activities of WG3 and Dr. Byron Jordan (Canada) commenced his term as the new Convenor of this working group.

- In the recent development of ISO Standards by this WG, there has been increasing recognition of the importance of having terminology in more strict accordance with CIE definitions. For example, in the recent technical revision of ISO 9416 – Paper – Determination of Light Scattering and Absorption Coefficients using Kubelka-Munk Theory, the Y value term, “luminous reflectance factor” has been replaced by the CIE ILV recommended term “luminance factor” and the illuminant condition is also now specified.
- WG3 is responsible for 12 Standards based on reflectance measurements. The current status of some of these standards is, as follows:
  - The ISO Standards on colour methods have been renumbered (following the plenary meeting of ISO/TC6 in June 2005) and regrouped under the ISO number 5631. Thus, the following ISO standards: 5631, 16692 and 20312 have been renumbered to 5631-1, 5631-2 and 5631-3, respectively.
  - ISO 5631-2 Paper and board – Determination of Colour – outdoor daylight conditions (D65/10°) is at the CD (committee draft) stage. This Standard cites CIE Publication 15.3: 2005 as one of its Normative References
  - ISO 5631-3 Paper and board – Determination of Colour (D50/2°) Diffuse Reflectance Method has been submitted for CD ballot.
  - ISO 2471 Paper and board – Determination of opacity (paper backing) – diffuse reflectance method has been technically revised in that a UV adjustment to conform to CIE Illuminant C is required if FWAs are present in the paper or board. This Standard is at the DIS stage.
  - ISO 11475 – CIE Whiteness (D65/10°), was last published in November 2004 and is not scheduled for review until 2009. Issues that will need to be resolved before then are inconsistencies in fluorescence terminology with CIE definitions and problem of negative values of the fluorescent component when materials contain very little FWA.

#### Other News:

- A new work item for a Technical Report on “Basic equations for optical properties” has been submitted to the ISO/TC6 secretariat for voting.
- WG3 is responsible for 3 standards on gloss determination. ISO 8254-1 Gloss at 75°, TAPPI - has been submitted for CD ballot.
- ISO/TC6 has liaisons with CIE, ISO/TC130-Graphic Arts, and ISO/TC38-Textiles. It is also planning to establish a liaison with the ICC.
- WG3 maintains an active liaison with CIE TC 1-57 (Dr. A. Bristow) on the development of colorimetric standards and CIE TC 1-66 (Dr. B.Jordan) on the development of a defined indoor illuminant.

